FIG. 1

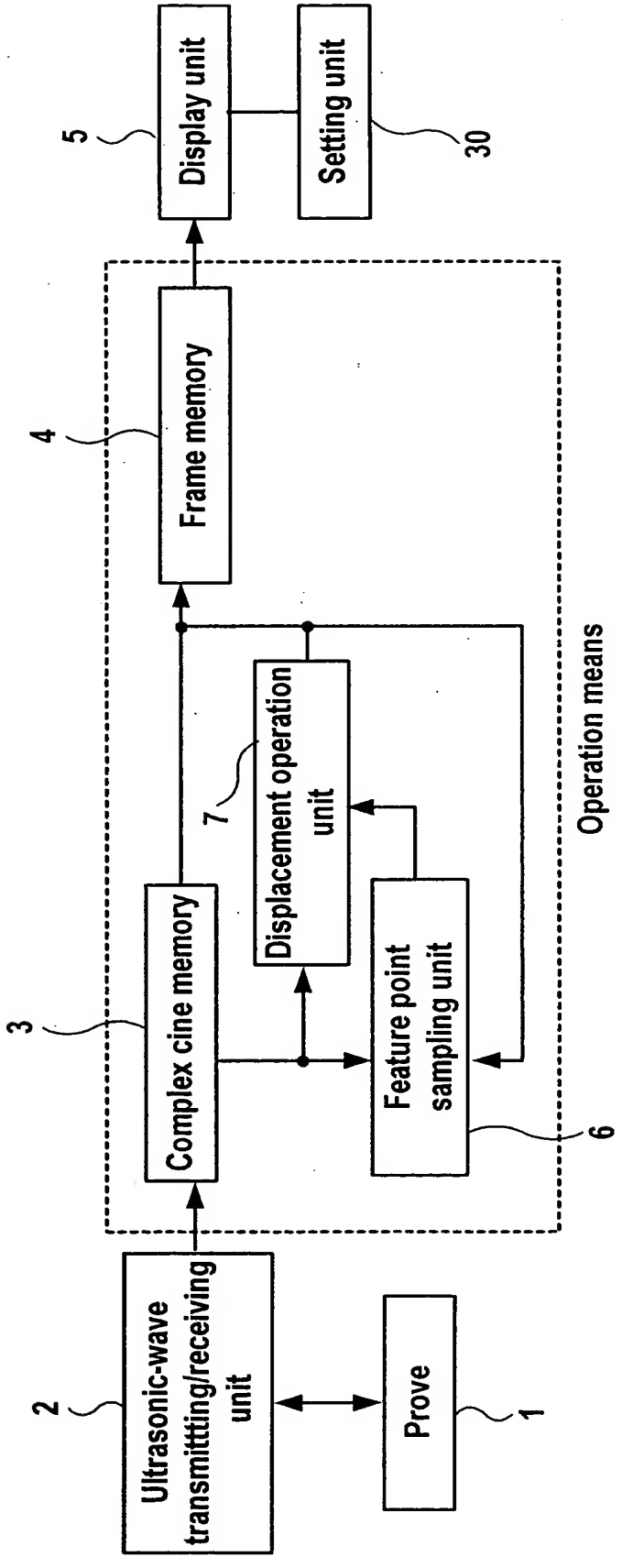

Ultrasonic-wave transmitting/receiving unit
2
Prove
1
Complex cine memory
3
Displacement operation unit
7
Feature point sampling unit
6
Frame memory
4
Operation means
Display unit
5
Setting unit
30

FIG. 2

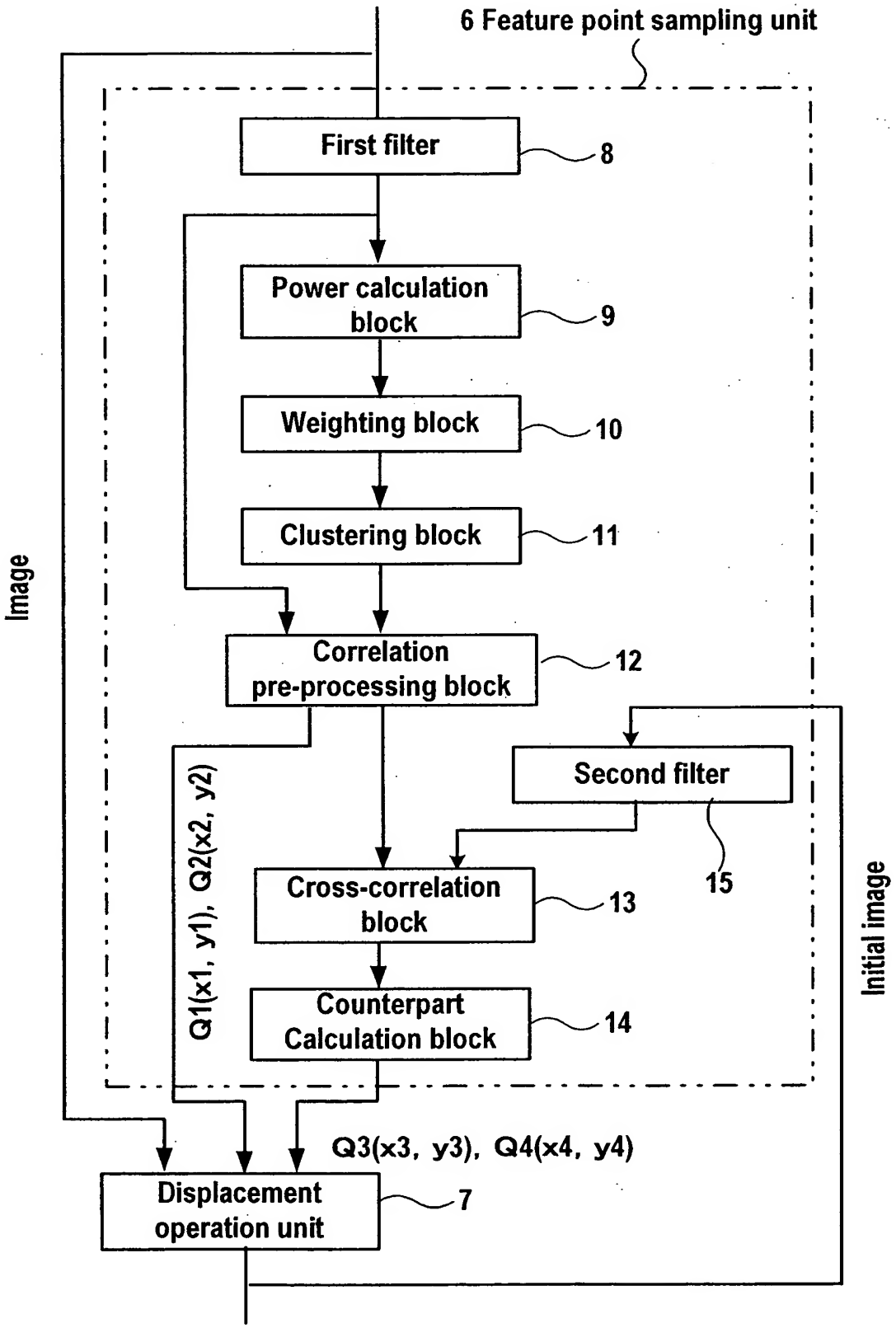

6 Feature point sampling unit
First filter
8
Power calculation block
9
Weighting block
10
Clustering block
11
Correlation pre-processing block
12
Second filter
15
Cross-correlation block
13
Counterpart Calculation block
14
Displacement operation unit
7
Image
Q1(x1, y1), Q2(x2, y2)
Q3(x3, y3), Q4(x4, y4)
Initial image

FIG. 3

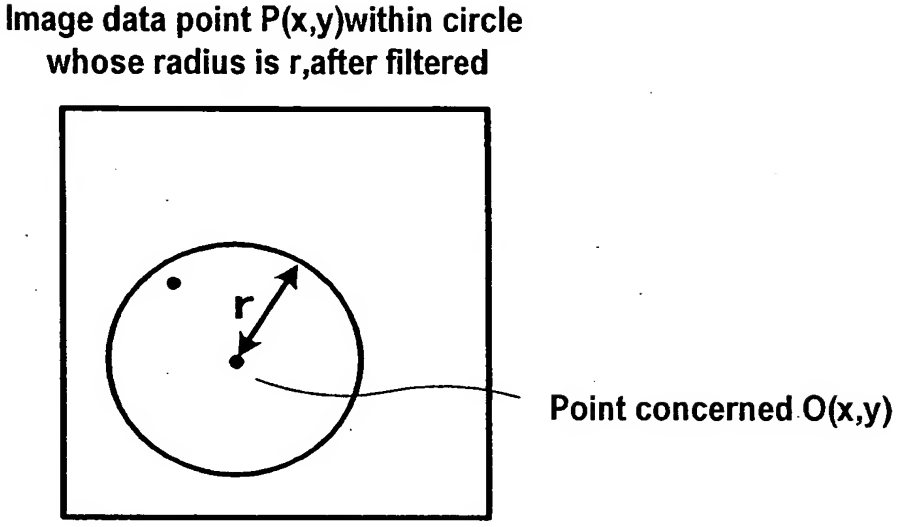


Image data point P(x,y)within circle
whose radius is r,after filtered
r
Point concerned O(x,y)

FIG. 4

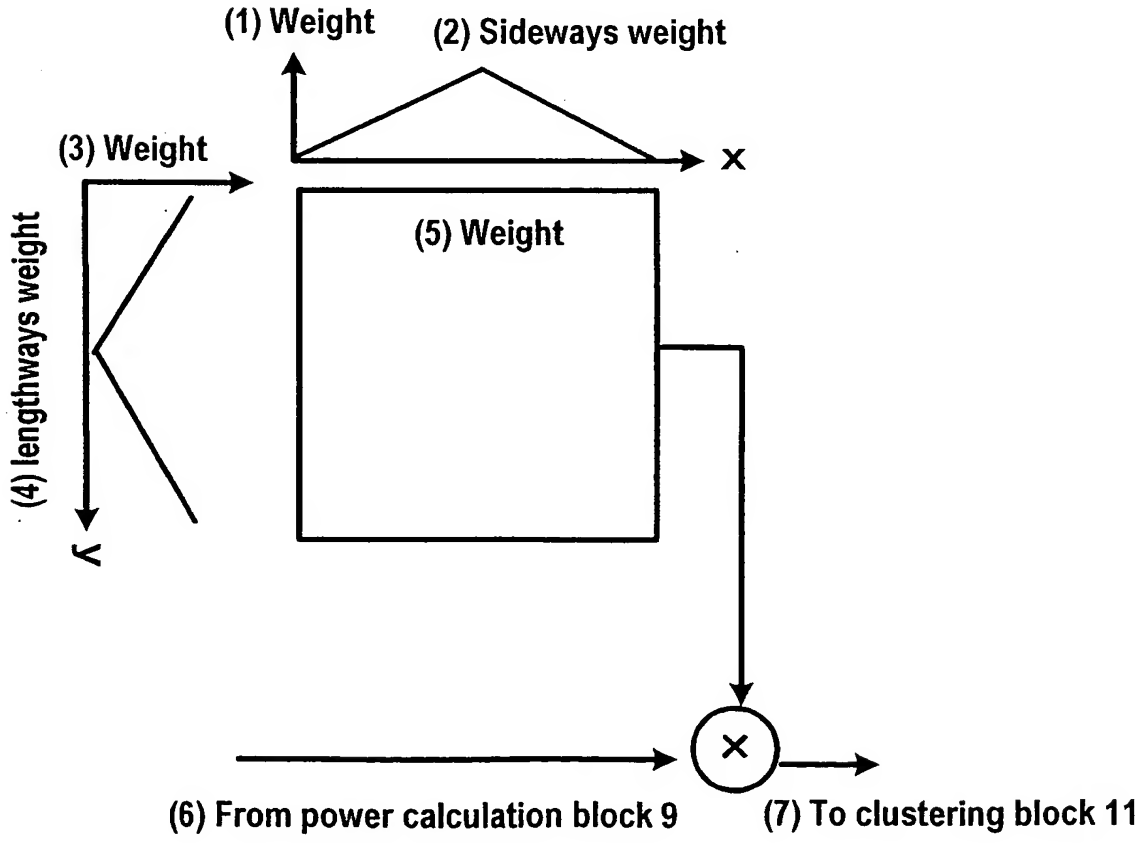

(1) Weight
(2) Sideways weight
(3) Weight
x
(5) Weight
(4) lengthways weight
y
(6) From power calculation block 9
(7) To clustering block 11

FIG. 5

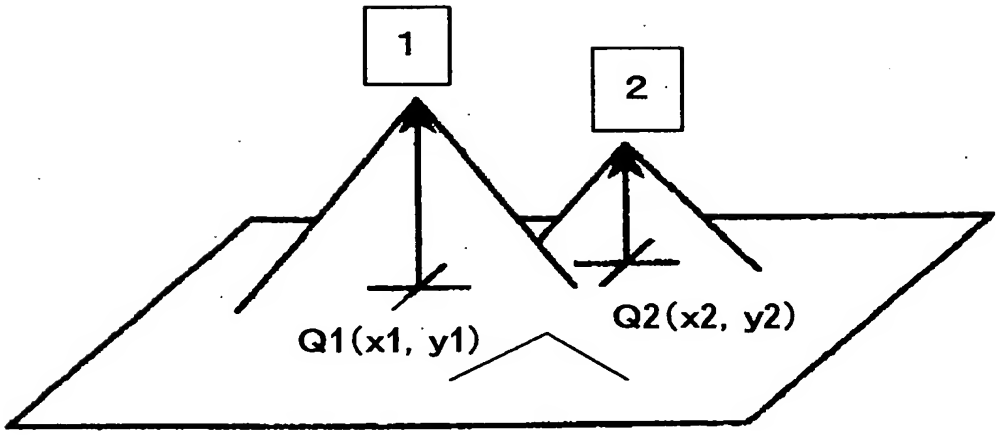

1
2
Q1(x1, y1)
Q2(x2, y2)

FIG. 6

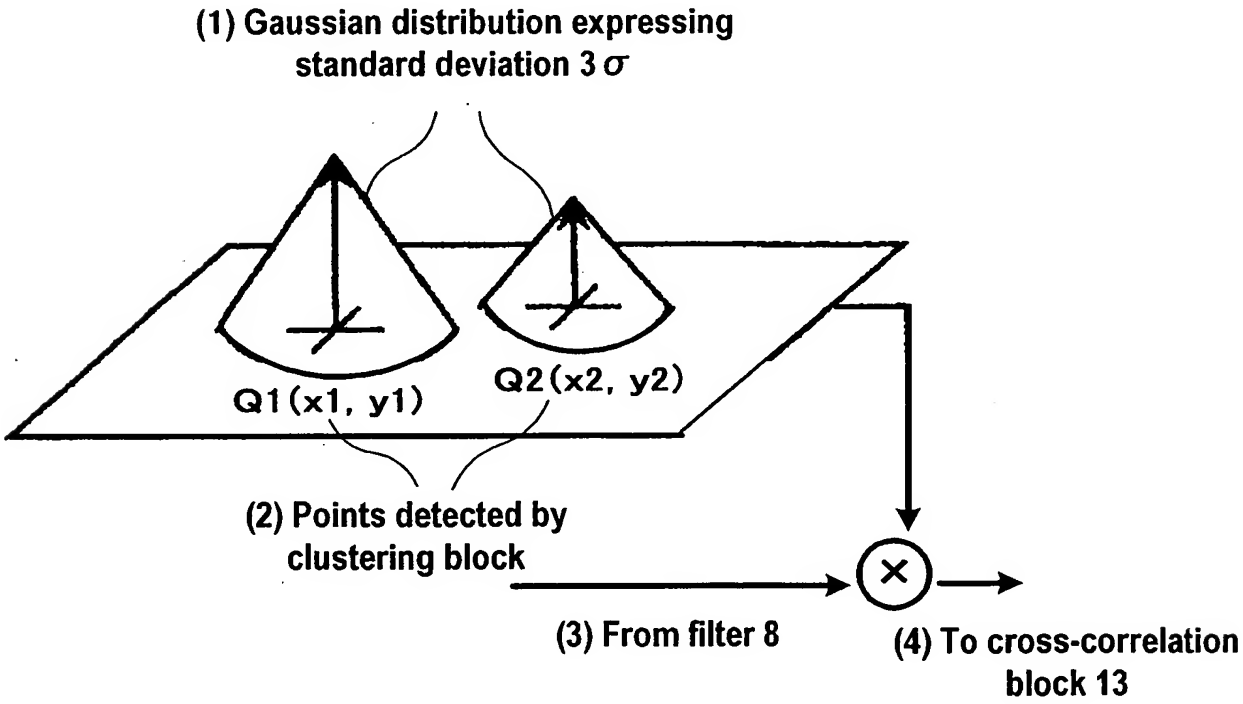
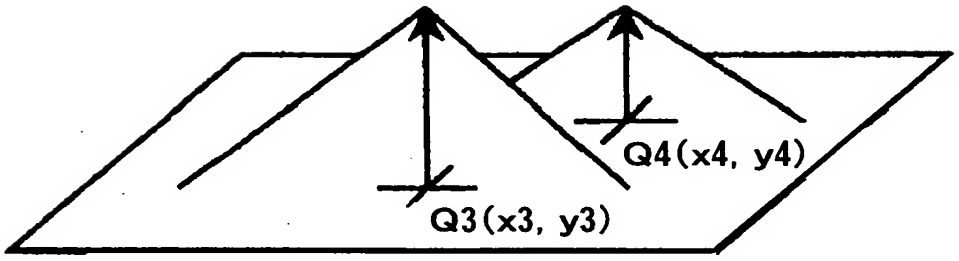

(1) Gaussian distribution expressing standard deviation 3σ
Q1(x1, y1)
Q2(x2, y2)
(2) Points detected by clustering block
(3) From filter 8
(4) To cross-correlation block 13

FIG. 7



Distribution of powers subjected to cross-correlation

FIG. 8

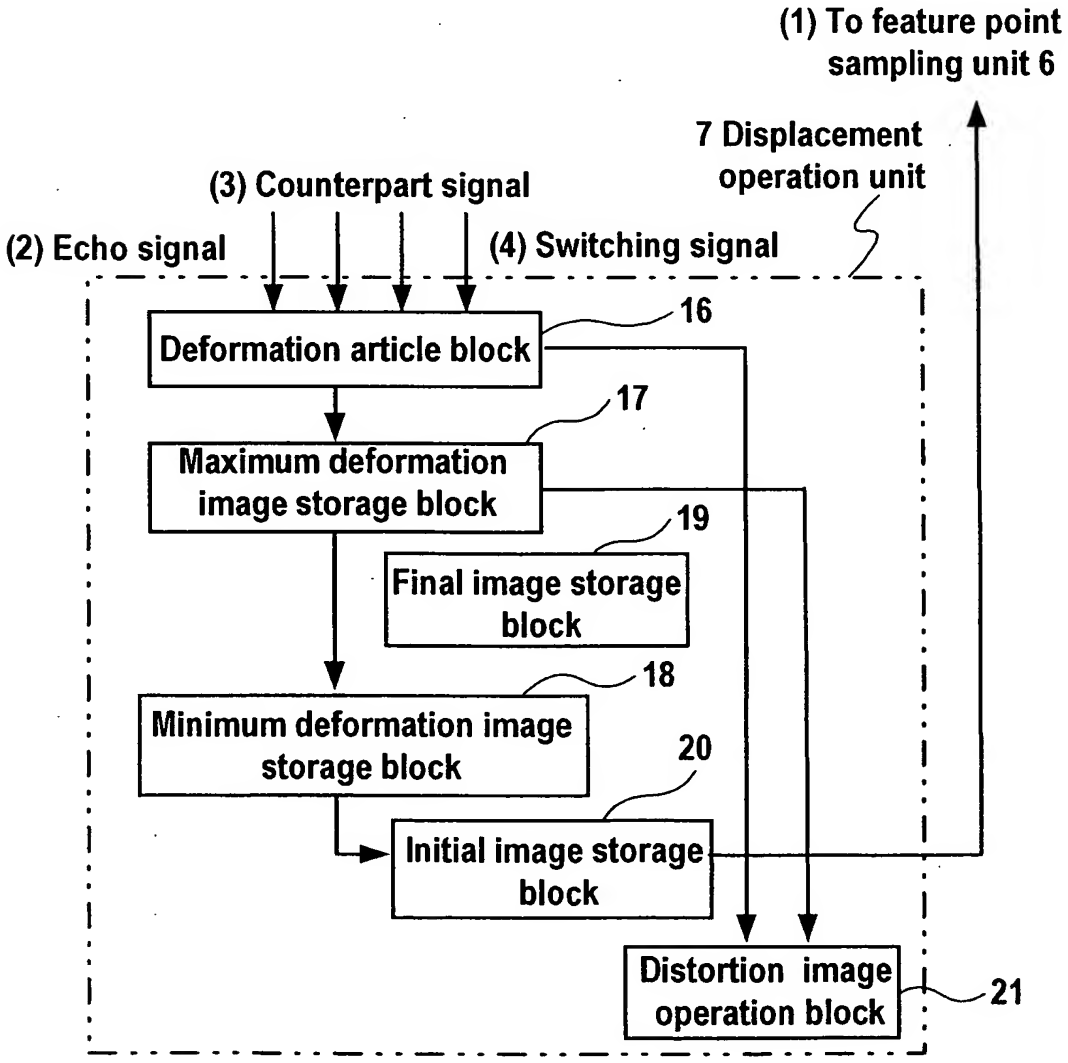


FIG. 9

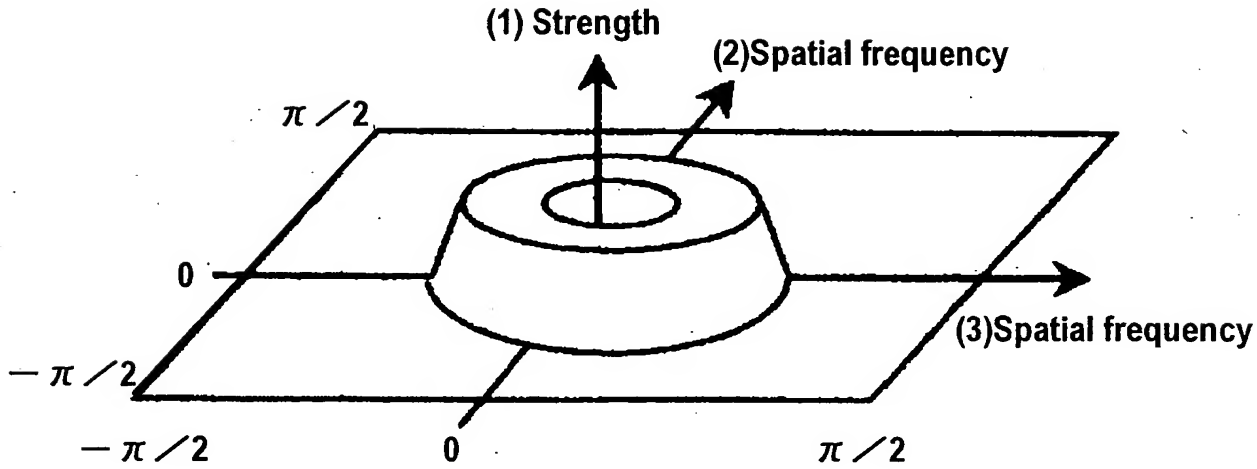

(1) Strength
(2)Spatial frequency
π／2
0
−π／2
(3)Spatial frequency
−π／2
0
π／2

FIG. 10

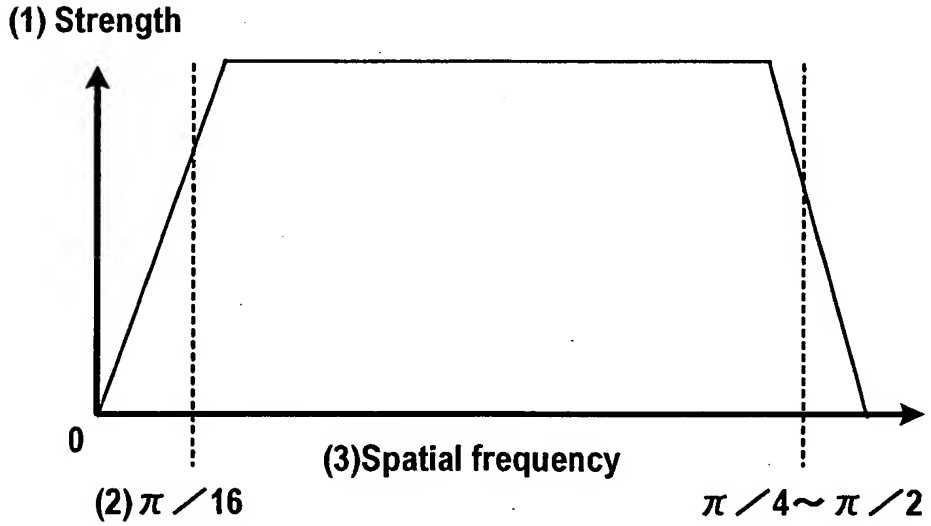

(1) Strength
0
(3)Spatial frequency
(2) π／16
π／4～π／2

FIG. 11A

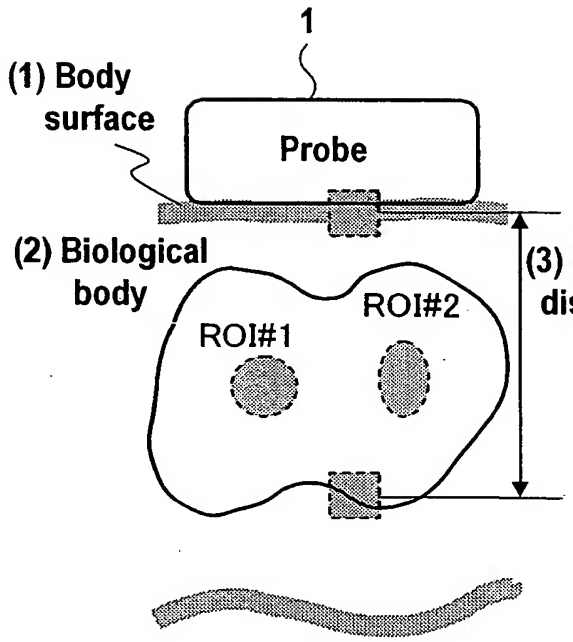


FIG. 11B

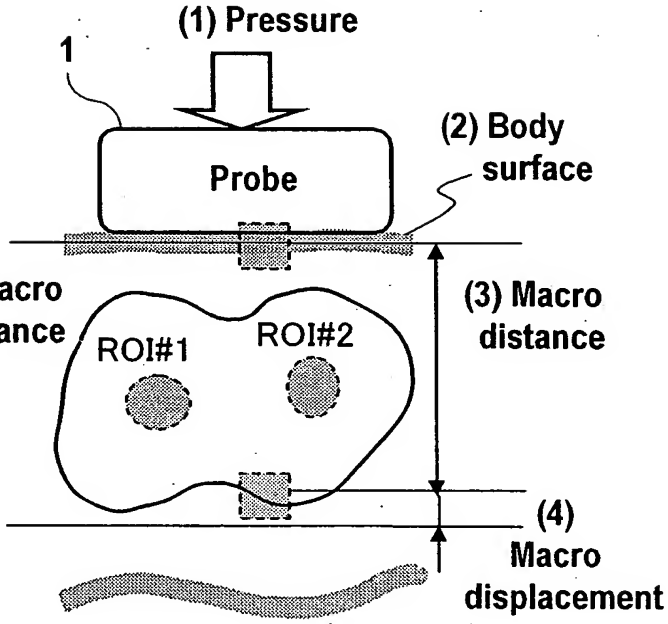


FIG. 12A

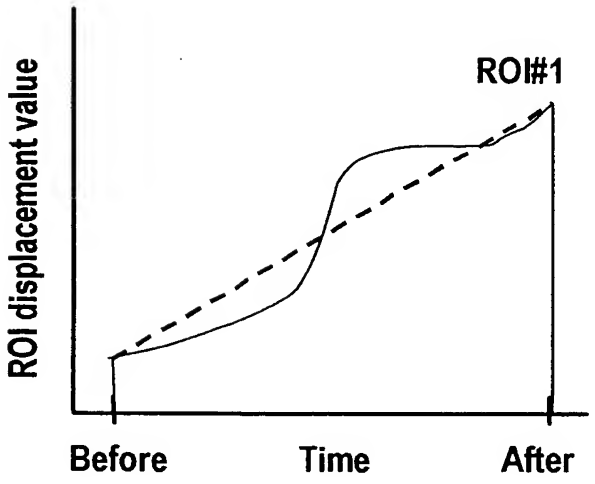


FIG. 12B

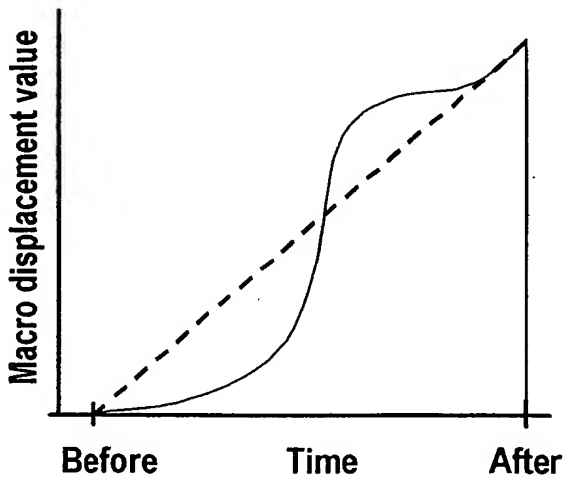


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FIG. 13

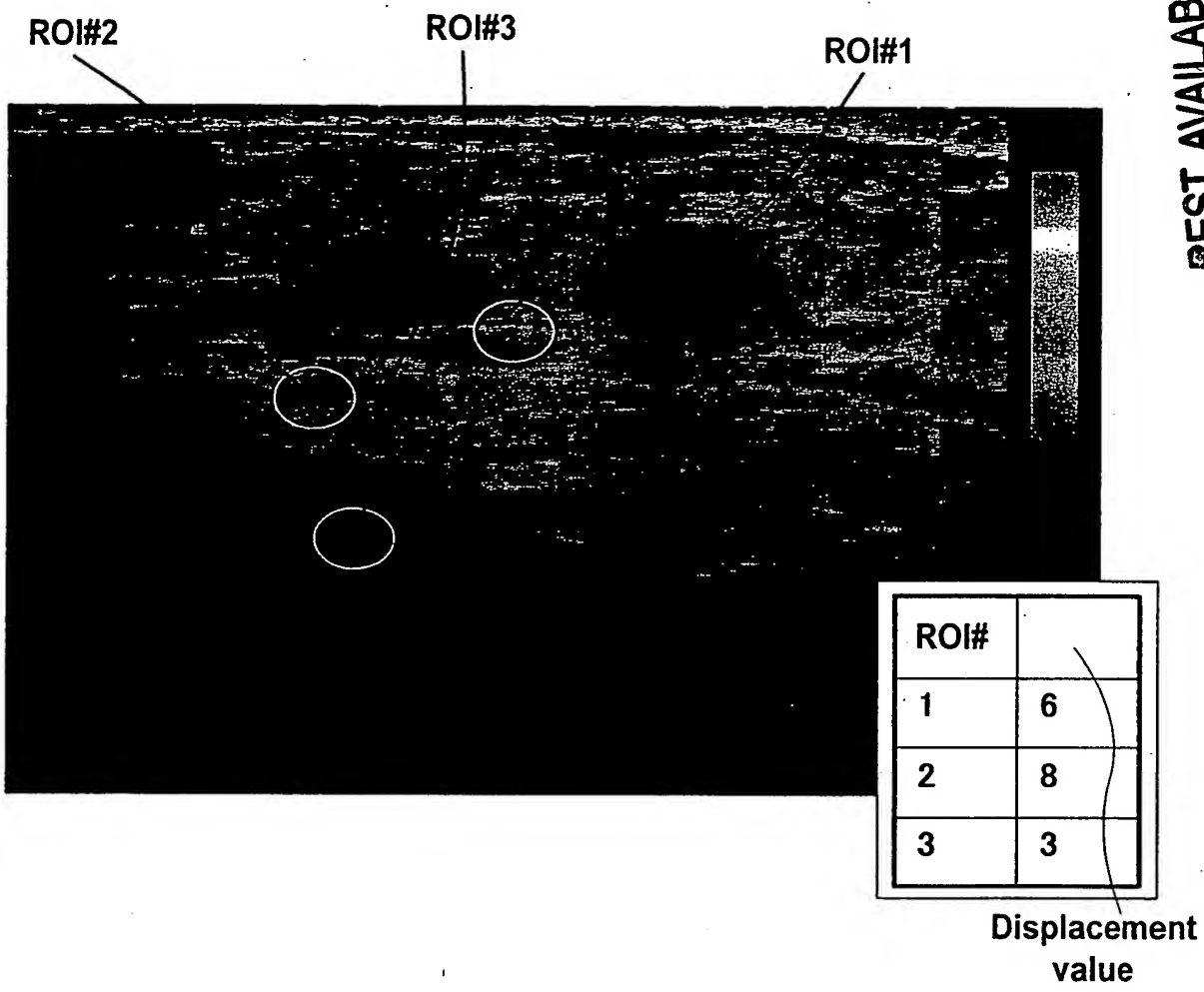


FIG. 14A

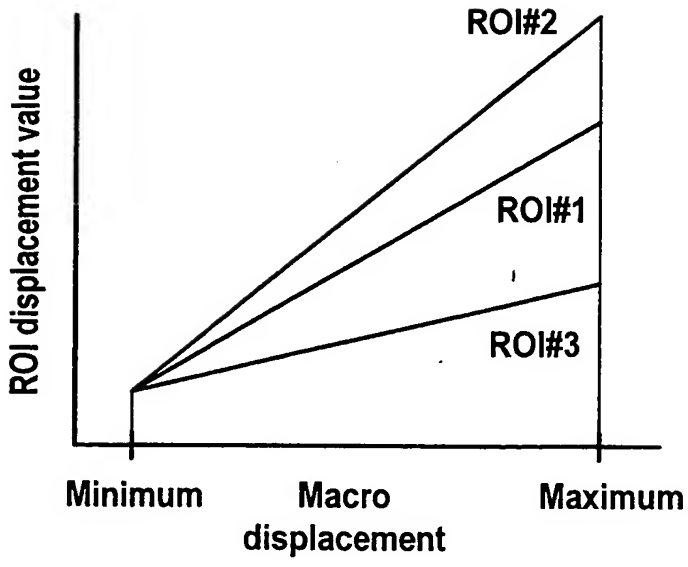


FIG. 14B

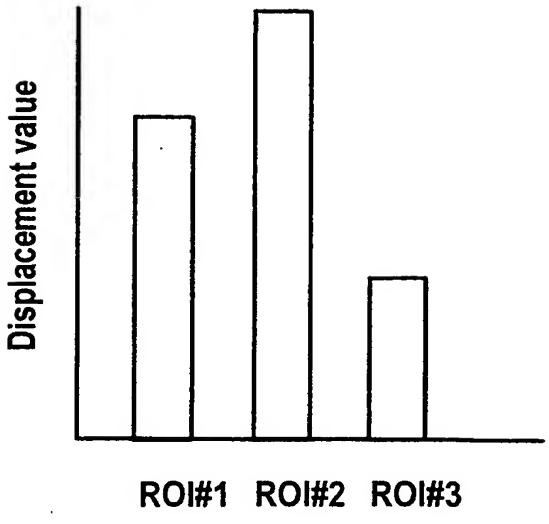
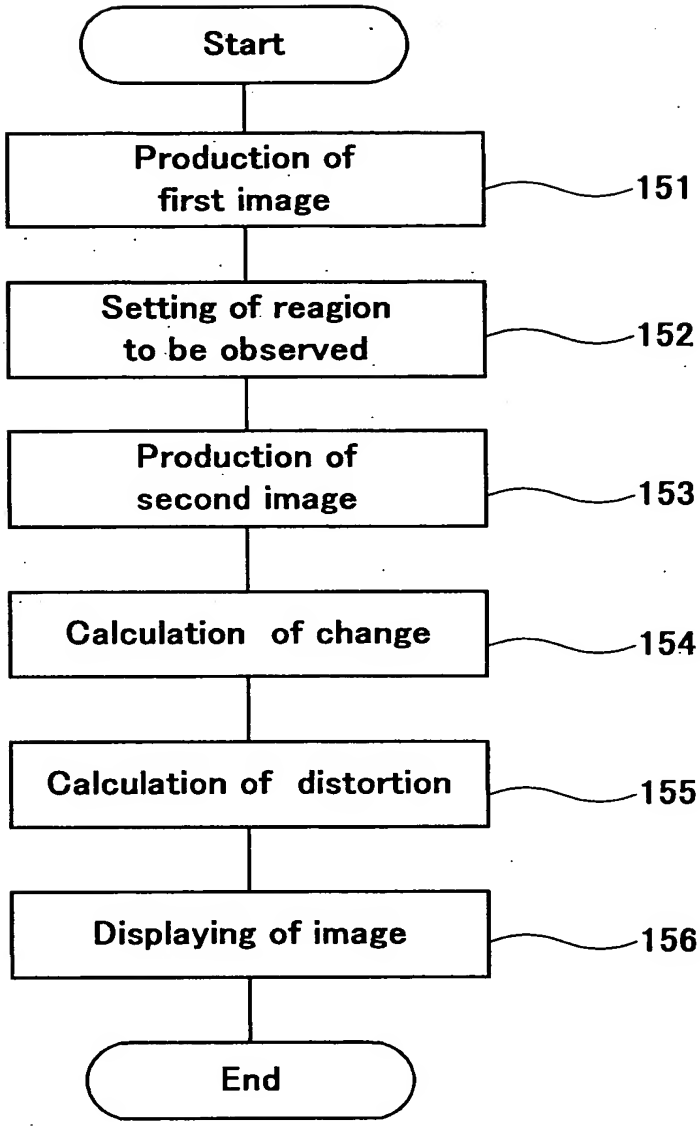


FIG. 15


Start
Production of first image
151
Setting of reagion to be observed
152
Production of second image
153
Calculation of change
154
Calculation of distortion
155
Displaying of image
156
End